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HANDBOOK

FOR

VIDEO RETURN LOSS BRIDGE

TVT/3/RLB

ELECTROCRAFT INSTRUMENTS LTD.
COOMBESWELL FARNHAM LANE HASLEMERE SURREY ENGLAND

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VIDEO RETURN LOSS BRIDGE

TVT/3/RLB

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ILLUSTRATIONS

CIRCUIT DIAGRAM	FIGURE 1

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1. APPLICATION

The TVT/3/RLB used in conjunction with a suitable wide band oscilloscope and video test signal generator enables easy and accurate measurements to be made of the return loss errors caused by the terminating impedance of 75 ohm coaxial lines.

This terminating impedance may be the input or output impedances of amplifiers, generators etc.

The return loss measurement covers a range of -26 to -66 db for 1V p-p input and is given by the equation

$$\text{R.L. in db} = -20 \log \frac{Zx + Zr}{10\ Zx - Zr}$$

where Zr = 75 ohms and Zx is the measured impedance. This range represents an error of terminating impedance of 10% to 0.1% or a Reflection Coefficient of 0.05 to 0.0005.

Using a Sine-squared pulse and bar generator the return loss errors can be shown to be either resistive, capacitive, inductive or complex, while other generators can be used, RF, sweep, bar and sub-carrier, augmented colour pulse and bar.

With a 1V composite test signal an output of 25 mV represents a return loss of 46 db. A smaller signal input will enable a return loss of less than -26 db, i.e. -10 db signal level will extend range to -16 db.

Designed as a portable equipment, this lightweight unit uses semi-conductors and integrated circuits throughout and is one of a number of companion units.

Two accurate 75 ohm terminating resistors in "through" boxes with extension leads are supplied and the unit is fitted with a Calibration/Use switch allowing accurate setting up, while Coarse, Fine and High Frequency balance controls are used.

The TVT/3/RLB is normally supplied in a portable case but a 19" rack mounting can be supplied which will house this unit and three other companion units.

2. TECHNICAL DATA

Outputs:-

(a) Error signal output to oscilloscope 25mV p-p for 1% terminating error (46 db return loss), from 75 ohms into 75 ohms
Noise level 4 mV p-p
BNC 75 ohm connector.

(b) Zr. Reference impedance, 75 ohms
BNC connector.

(c) Zx. Unknown impedance, 75 ohms
BNC connector.

Inputs:-

(a) Mains Supply 200-250 volts
40-60 Hz.

(b) Signal input, 75 ohms
1V p-p composite, normal use but 1 V p-p sweep frequency signal can be used.

Measurement Range: Return loss -26 db to -66 db) Reflection Coefficient 0.05) to 0.0005) for 1V p-p input signal

Bandwidth: Better than 15 MHz

Dimensions: Unit Front panel 4" wide x 7" high x 8" deep
Portable case 4.4" wide x 7.3" high x 9.3" deep with carrying handle and feet.

Front Panel:-

Controls: Balance Coarse) Balance Fine) L.F.
Balance H.F.

Preset Controls: GAIN

Switches: Mains ON/OFF
CAL 1%/USE

Connectors: Signal output) Zx) Zr) Signal input) BNC

Lamps: Mains Neon

3. CIRCUIT DESCRIPTION

The signal being used for the test feeds into one arm of the bridge R_1 and R_2 via the signal input socket, the other arms of the bridge consisting of the external resistors Zx and Zr, all accurate 75 ohm resistors. Switch S1 adds R31 across one arm of the bridge to provide a 1% error signal.

Resistive balance of the bridge is achieved by two variable potentiometers, R5 Coarse and R8 Fine, while the reactive balance is achieved by the variable differential capacitor C15.

The two outputs from the bridge feed into a wideband differential amplifier consisting of the integrated circuit IC1.

Common mode d.c. feed back is achieved via the inverting amplifier VT5 with adjustments R18 and R11 to stabilise the d.c. working points of the amplifier for environmental changes.

A balanced to single ended output stage VT1 and VT2 is used to buffer the amplified output signals from the IC amplifier and this stage allows preset adjustment of gain and a 75 ohm output impedance.

The ± 5V d.c. power supply consists of a double wound mains transformer T1 feeding a bridge rectifier with a capacitive filter feeding a conventional stabilised supply, with a series control transistor VT3, a d.c. amplifier VT4 and a reference zener diode D2.

4. OPERATION

4.1 General

The TVT/3/RLB is supplied complete with two accurate 75 ohm terminating resistors in through boxes with extension leads. The unit is supplied ready for use on 200/250 volts 50 cycles A.C. supply, colour coding on the mains lead being as follows:-

Brown or Red	Mains Live
Blue or Black	Mains Neutral
Green/Yellow or Green	Mains Earth

4.2 Controls

Before switching on the user should become familiar with the functions of the various controls. All the preset controls

will have been accurately set during manufacture and will not usually need adjustment during normal use.

GAIN	Used to calibrate instrument using internal 1% error (See Test Schedule 5.4.6)
CAL/USE SW.	Put in 'CAL' position to calibrate (in conjunction with Gain Control) Put in 'USE' position for normal use.
BALANCE L.F. COARSE) BALANCE L.F. FINE) BALANCE H.F.)	Used to Zero output (See Test Schedule 5.4.5)

5. MAINTENANCE

5.1 Removal of Case

Four 6BA chrome headed screws with washers, one in each corner of the front panel bold the unit in its case. Remove these and the unit may be carefully eased out frontwards. All transistors are fitted with plug in bases. When unit is replaced in its case, ensure rear panel is centered in hole before tightening.

5.2 Schedule of Tests

The following section based on the factory Test Schedule are included to enable the user to make a series of tests by which the main points of performance of the instrument can be checked.

5.3 Apparatus Required

(a) Multimeter (capable of being set to centre zero on D.C. volts ranges).

(b) Wide Band Oscilloscope.

(c) Pulse and Bar (1 volt p-p)

5.4 Test Procedure

Terminate Zx and Zr using the 75 ohm terminating resistors and the correct leads as supplied.

5.4.1 Check A.T.

Connect multimeter between C11 (+) and OV. The reading should be +5V approx.

5.4.2 Connect multimeter between C12(-) and OV. The reading should be -5V approx.

5.4.3 Set D.C. Balance

Connect Multimeter across R15 and R16. Set meter to centre zero and adjust R11 of minimum reading. This should be better than 50mV.
(Note:- commence this test on 10V range and reduce).

5.4.4 Check H.T.

Connect multimeter between C11(+) and OV. The reading should now be +5V ± 5%.
Connect multimeter between C12(-) and OV. The reading should now be -5V ± 5%.

5.4.5 Set Balance

Set R18 (D.C. out) to mid position.
Connect oscilloscope to output and terminate with 75 ohm 1% resistor.
Connect Pulse and Bar to input (1V p-p)
Put Cal. Switch in 'Use' position
Observe waveform and adjust Coarse Fine and H.F. balance controls on front panel for Zero Output.

5.4.6 Set Gain

Put Cal. Switch in (Cal 1%) position and adjust Gain Control on front panel for output of 25 mV p-p.

Set D.C. Output

Connect Multimeter to output and adjust R18 for -1V ± 5%
Recheck Balance and Gain settings and adjust Balance Gain and D.C. Out Controls until the correct results are obtained.

5.4.7 Noise Level

Check that noise level is less than 4mV.

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Circuit Ref.	Description	Detail	Remarks
R1	Resistor fixed 75Ω ± 5% Selected to 0.1%	PIHER WPO51	WAYCOM LIMITED
R2	Resistor fixed 75Ω ± 5% Selected to 0.1%	PIHER WPO51	WAYCOM LIMITED
R3	Resistor fixed 75Ω ± 5% Selected to 0.1%	PIHER WPO51	WAYCOM LIMITED
R4	Resistor fixed 4K7Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R5	Potentiometer 10KΩ	Type P6-A	GUEST ELECTRONICS
R6	Resistor fixed 4K7Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R7	Resistor fixed 22KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R8	Potentiometer 10KΩ	Type P6-A	GUEST ELECTRONICS
R9	Resistor fixed 22KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R10	Resistor fixed 150KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R11	Min. Potentiometer 100KΩ	Type PN11B	GUEST ELECTRONICS
R12	Resistor fixed 150KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R13	Resistor fixed 10KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R14	Resistor fixed 10KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R15	Resistor fixed 5K6Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R16	Resistor fixed 5K6Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R17	Resistor fixed 100Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R18	Min. Potentiometer 500Ω	Type P11-B	GUEST ELECTRONICS
R19	Resistor fixed 560Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R20	Resistor fixed 2K2Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R21	Resistor fixed 75Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R22	Resistor fixed 390Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R23	Resistor fixed 75Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R24	Potentiometer 75Ω W.W.	Colvern 1106/11S	COLVERN LTD.
R25=	Resistor fixed 82Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R26	Resistor fixed 680Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R27	Resistor fixed 430Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R28	Resistor fixed 680Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R29	Resistor fixed 1KΩ ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R30	Resistor fixed 7K5Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED
R31	Resistor fixed 7K5Ω ± 5% ½W	PIHER WPO51	WAYCOM LIMITED

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Circuit Ref.	Description	Detail	Remarks
C1	Capacitor Elect. 500µF 2.5V	C426AR/A500	MULLARD
C2	Capacitor Elect. 500µF 2.5V	C426AR/A500	MULLARD
C3	Capacitor Elect. 500µF 2.5V	C426AR/A500	MULLARD
C4	Capacitor Elect. 500µF 2.5V	C426AR/A500	MULLARD
C5	Capacitor Elect. 500µF 2.5V	C426AR/A500	MULLARD
C6	Capacitor fixed 0.1µF 250V	M312	HUNTS
C7	Capacitor fixed 0.1µF 250V	M312	HUNTS
C8	Capacitor fixed 0.1µF 250V	M312	HUNTS
C9	Capacitor fixed 0.47µF 10V	Low voltage Disc Ceramic	RADIOSPARES
C10	Capacitor fixed 0.47µF 10V	Low voltage Disc Ceramic	RADIOSPARES
C11	Capacitor Elect. 1000µF 10V	C437/ARD 1000	MULLARD
C12	Capacitor Elect. 1000µF 10V	C437/ARD 1000	MULLARD
C13	Capacitor Elect 250µF 16V	C437 AR/E250	MULLARD
C14	Capacitor Elect. 640µF 25V	C437 AR/F640	MULLARD
C15	Differential Trimmer Capacitor 3-10pf	C702	JACKSON BROS.(LONDON) LTD.
D1	Zener Diode BZY88	BZY88-C4V7	MULLARD
D2	Zener Diode BZY88	BZY88-C5V6	MULLARD
D3-6	Diode BY234		
VT1	Transistor 2N4291	PIHER	WAYCOM LIMITED
VT2	Transistor 2N4291	PIHER	WAYCOM LIMITED
VT3	Transistor BF40347	BF40347	RCA
VT4	Transistor 2N4286	PIHER	WAYCOM LIMITED
VT5	Transistor 2N4289	PIHER	WAYCOM LIMITED
IC-1	Integrated Circuit SN7510L	6814A	

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Circuit Ref.	Description	Detail	Remarks
Zx	Resistor fixed 75Ω ± Selected to 0.1%	T	
Zr	Resistor fixed 75Ω ± Selected to 0.1%		
LP1	Neon Lamp	Type PC/D 160 to 260V	WEST HYDE DEVELOPMENTS
T1	Transformer	13V Fil	RADIOSPARES
S1	Switch Toggle	Miniature 2 Amp	PAINTON
S2	Switch Toggle	Miniature 2 Amp	PAINTON

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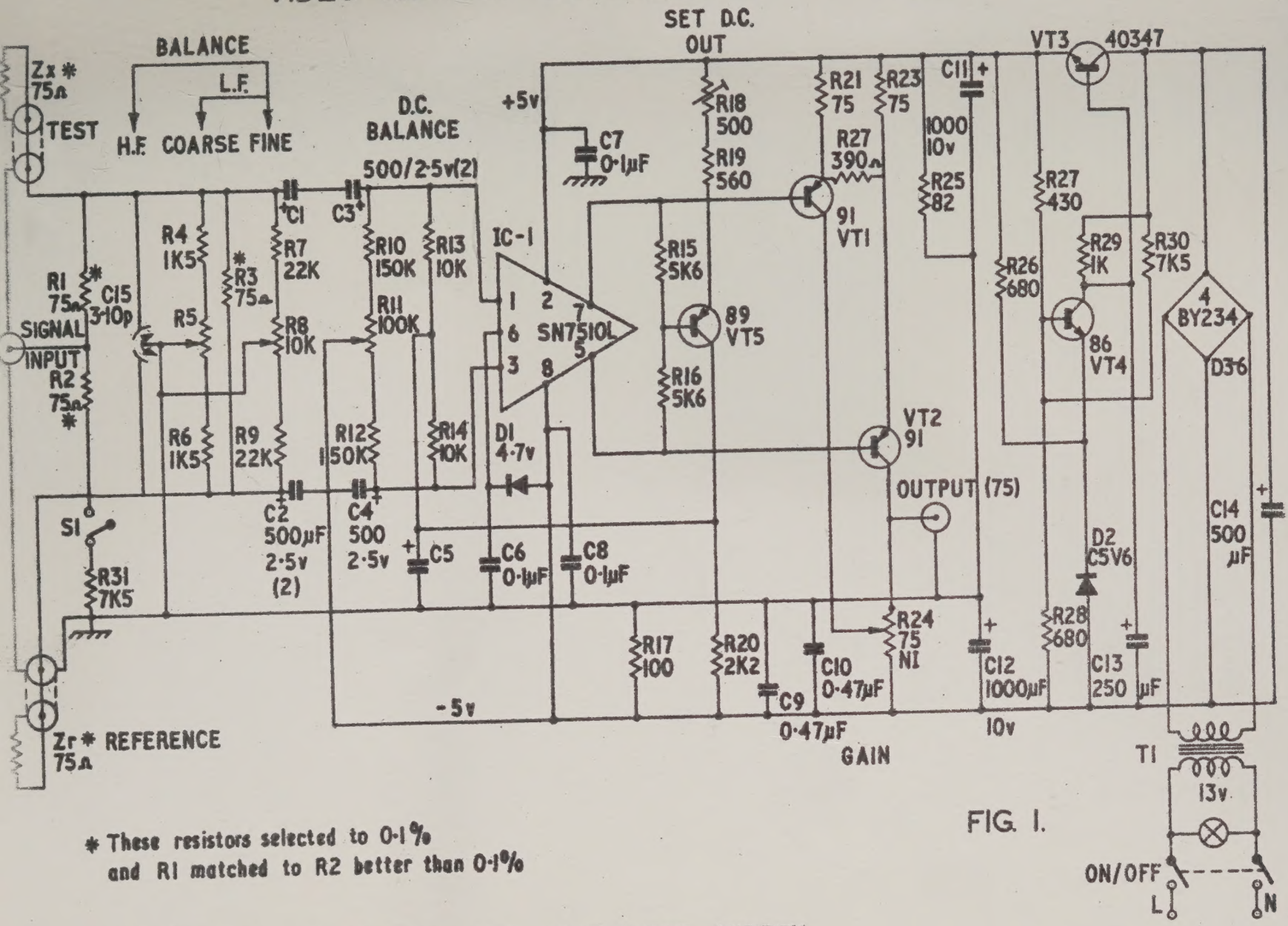

FIG. 1.

* These resistors selected to 0·1% and R1 matched to R2 better than 0·1%

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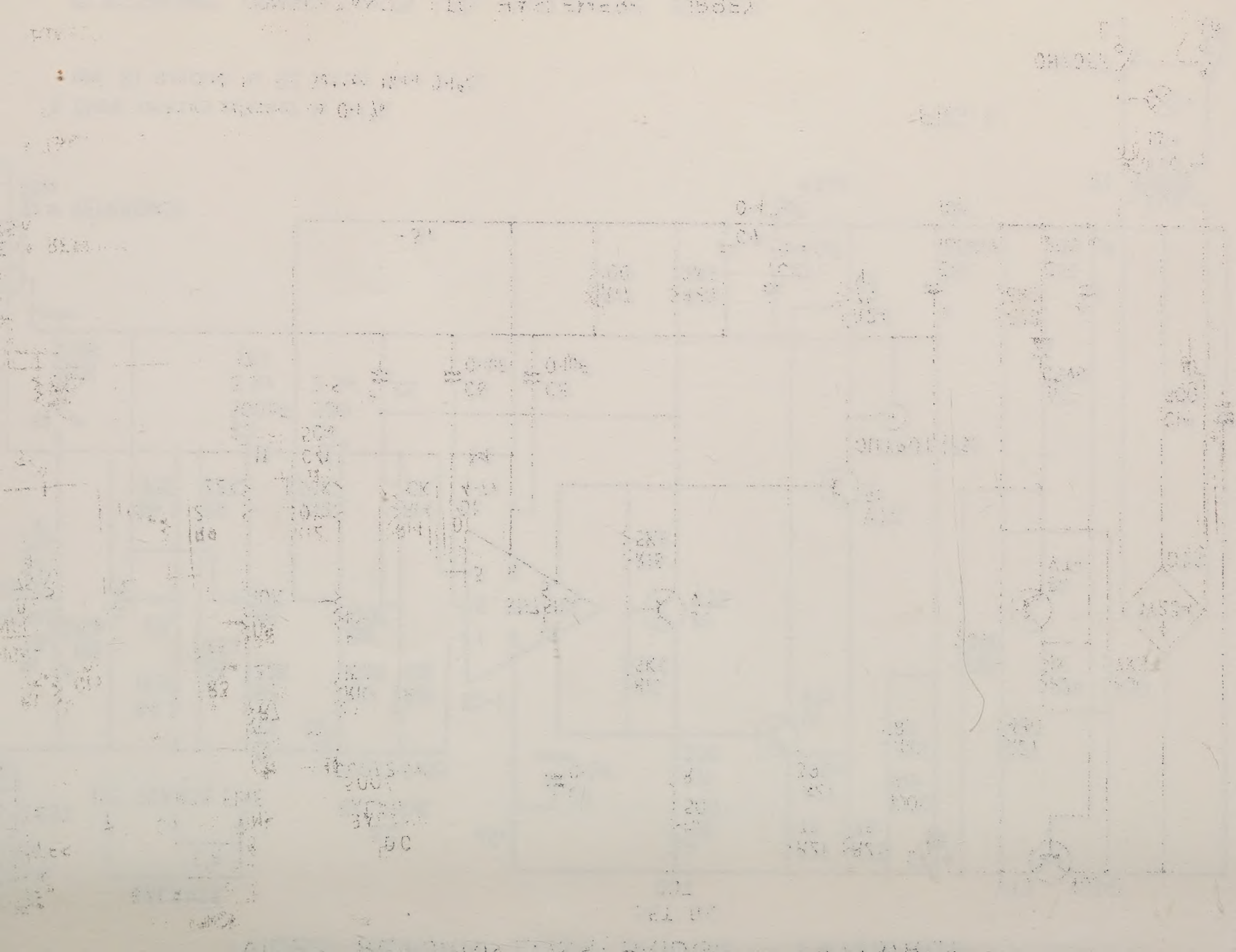

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